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A study of the seasonal asymmetry of the diurnal and semidiurnal geomagnetic variations

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Following Wulf's pioneering work in the early sixties, very few studies were devoted to the seasonal asymmetry of the diurnal and semidiurnal geomagnetic variations. Here we revisit this problem using long series of hourly values (up to 97 years at Sitka) recorded at several observatories throughout the world. The seasonal variations of amplitude of the 12-hour and 24-hour lines for the H and Z components are obtained by Fourier analysis over a 28-day sliding window, using either all days within the window or only the five quietest days. In order to quantify the asymmetry between spring and fall, we introduce an ad hoc coefficient computed for each year. We find that the average asymmetry is maximum at mid-latitudes, for both lines and both components, when all days are considered. When selecting quiet days, this asymmetry generally increases and becomes comparable at mid- and low latitudes. When averaged over the entire series, the sign of the asymmetry is the same at nine out of ten mid-latitude observatories for both lines and for a given component; it is opposite for the H and Z component. Such a coherent seasonal asymmetry is not found at low- and high-latitudes. At all latitudes, the year-to-year variations of the seasonal asymmetry are uncorrelated with solar activity. These results suggest that the seasonal asymmetry is a global phenomenon due to a corresponding asymmetry in lower-thermospheric winds.